STOICHIOMETRY REVIEW ANSWER KEY.

1a) $\frac{2.6\text{ mol } NH_3 \mid 6\text{ mol } H_2O}{4\text{ mol } NH_3} = 3.9\text{ mol } H_2O$

b) $\frac{0.362\text{ mol } O_2 \mid 4\text{ mol NO}}{5\text{ mol } O_2} = 0.290\text{ mol NO}$

c) $\frac{54.0\text{ g } NH_3 \mid 1\text{ mol } NH_3 \mid 5\text{ mol } O_2}{17.0\text{ g } NH_3 \mid 4\text{ mol } NH_3} = 3.97\text{ mol } O_2$

d) $\frac{60.0\text{ g } H_2O \mid 1\text{ mol } H_2O \mid 4\text{ mol NO}}{18.0\text{ g } H_2O \mid 6\text{ mol } H_2O} = 2.22\text{ mol NO}$

e) $\frac{8.96\text{ g } NH_3 \mid 1\text{ mol } NH_3 \mid 4\text{ mol NO} \mid 30.0\text{ g NO}}{17.0\text{ g } NH_3 \mid 4\text{ mol } NH_3 \mid 1\text{ mol NO}} = 15.8\text{ g NO}$

(2) $2SO_3 \longrightarrow 2S + 3O_2$

$\frac{6.0\text{ mol } SO_3 \mid 2\text{ mol S} \mid 32.1\text{ g S}}{2\text{ mol } SO_3 \mid 1\text{ mol S}} = 1.9 \times 10^2\text{ g S}$

(3) $Na_2SO_4 + BaCl_2 \longrightarrow 2NaCl + BaSO_4$

$\frac{2.50\text{ mol } Na_2SO_4 \mid 2\text{ mol NaCl} \mid 58.5\text{ g NaCl}}{1\text{ mol } Na_2SO_4 \mid 1\text{ mol NaCl}} = 293\text{ g NaCl}$

(4) $C + 2Cl_2 \longrightarrow CCl_4$

$\frac{355\text{ g } CCl_4 \mid 1\text{ mol } CCl_4 \mid 2\text{ mol } Cl_2 \mid 71.0\text{ g } Cl_2}{154.0\text{ g } CCl_4 \mid 1\text{ mol } CCl_4 \mid 1\text{ mol } Cl_2} = 327\text{ g } Cl_2$

⑤ $2H_2S + 3O_2 \longrightarrow 2H_2O + 2SO_2$

$$\frac{9.0\,g\,H_2O \mid 1\,mol\,H_2O \mid 3\,mol\,O_2 \mid 32.0\,g\,O_2}{18.0\,g\,H_2O \mid 2\,mol\,H_2O \mid 1\,mol\,O_2} = \underline{24\,g\,O_2}$$

⑥a

$$\frac{0.316\,g\,C_{14}H_{10}O_3S \mid 1\,mol\,C_{14}H_{10}O_3S \mid 14\,mol\,CO_2 \mid 22.4\,L\,CO_2}{258.1\,g\,C_{14}H_{10}O_3S \mid 1\,mol\,C_{14}H_{10}O_3S \mid 1\,mol\,CO_2} = \underline{0.384\,L\,CO_2}$$

⑥b

$$\frac{16.5\,L\,SO_2 \mid 1\,mol\,SO_2 \mid 1\,mol\,SO_2 \mid 258.1\,g\,C_{14}H_{10}O_3S}{22.4\,L\,SO_2 \mid 1\,mol\,C_{14}H_{10}O_3S \mid 1\,mol\,C_{14}H_{10}O_3S} = \underline{190\,g\,C_{14}H_{10}O_3S}$$

⑦

$$\frac{120\,g\,C_6H_{12}O_6 \mid 1\,mol\,C_6H_{12}O_6 \mid 6\,mol\,O_2 \mid 22.4\,L\,O_2}{180.0\,g\,C_6H_{12}O_6 \mid 1\,mol\,C_6H_{12}O_6 \mid 1\,mol\,O_2} = \underline{9.0\times10^{1}\,L\,O_2}.$$

$C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O$

⑧

$$\frac{8.73\,L\,H_2 \mid 1\,mol\,H_2 \mid 1\,mol\,O_2 \mid 22.4\,L\,O_2}{22.4\,L\,H_2 \mid 2\,mol\,H_2 \mid 1\,mol\,O_2} = \underline{4.37\,L\,O_2}$$

⑨

$$\frac{50.0\,L\,CO \mid 1\,mol\,CO \mid 1\,mol\,CO_2 \mid 22.4\,L\,CO_2}{22.4\,L\,CO \mid 2\,mol\,CO \mid 1\,mol\,CO_2} = \underline{25.0\,L\,CO_2}$$

(10.) $2C_2H_2 + 5O_2 \longrightarrow 4CO_2 + 2H_2O$

moles CO_2 = $\frac{50.0\,g\ O_2}{32.0\,g\ O_2} \times \frac{1\,mol}{} \times \frac{4\,mol\ CO_2}{5\,mol\ O_2}$ = 1.25 mol CO_2

moles CO_2 = $\frac{25.0\,g\ C_2H_2}{26.0\,g\ C_2H_2} \times \frac{1\,mol}{} \times \frac{4\,mol\ CO_2}{2\,mol\ C_2H_2}$ = 1.92 mol CO_2

The limiting reactant is O_2 as it produces the least amount of CO_2.

mass CO_2 produced $\frac{1.25\,mol\ CO_2}{1\,mol\ CO_2} \times \frac{44.0\,g\ CO_2}{} = 55.0\,g\ CO_2$ produced

The reactant in excess is C_2H_2 and the amount of it consumed is

$\frac{1.25\,mol\ CO_2}{4\,mol\ CO_2} \times \frac{2\,mol\ C_2H_2}{} \times \frac{26.0\,g\ C_2H_2}{1\,mol\ C_2H_2}$ = 16.3 g C_2H_2 used in rxn

The amount of C_2H_2 left over is

$25.0\,g - 16.3\,g = 8.7\,g$

(11.) $2HCl + Mg(OH)_2 \longrightarrow 2H_2O + MgCl_2$.

moles H_2O = $\frac{5.0\,g\ HCl}{36.5\,g\ HCl} \times \frac{1\,mol\ HCl}{} \times \frac{2\,mol\ H_2O}{2\,mol\ HCl}$ 0.137 mol (only 2 s.f. to work with)

moles H_2O = $\frac{24.0\,g\ Mg(OH)_2}{58.3\,g\ Mg(OH)_2} \times \frac{1\,mol\ Mg(OH)_2}{} \times \frac{2\,mol\ H_2O}{1\,mol\ Mg(OH)_2}$ = 0.823 mol

The limiting reactant is HCl as it produces the least amount of H_2O.

mass H_2O produced $\frac{0.137\,mol\ H_2O}{1\,mol\ H_2O} \times \frac{18.0\,g\ H_2O}{} = 2.5\,g\ H_2O$.

The reactant in excess is ~~C_2H_2~~ $Mg(OH)_2$ and the amount consumed is ....

$$0.137 \text{ mol } H_2O \left| \frac{1 \text{ mol } Mg(OH)_2}{2 \text{ mol } H_2O} \right| \frac{58.3 \text{ g } Mg(OH)_2}{1 \text{ mol } Mg(OH)_2} = 4.0 \text{ g } Mg(OH)_2 \text{ used.}$$

The amount of $Mg(OH)_2$ left over is

$$24.0 \text{ g} - 4.0 \text{ g} = \underline{\underline{20.0 \text{ g}}}$$

(12) Stoichiometry: The method to calculate the quantities of chemicals in a chemical reaction.

Stoichiometric Ratio: The mole ratio of two substances in a chemical reaction.

Limiting Reagent (Reactant): The reactant that runs out first in a reaction thereby limiting the amount of products formed.